BEAR CREEK WATERSHED ANALYSIS
FIRE/FUELS

CHARACTERIZATION

The Bear Creek Watershed Analysis Area consists of the area of land that is drained by Bear Creek and it's tributaries. It also includes the Big Elk Mountain and Current Creek drainages. This includes approximately 70,000 acres of the northern portion of the Caribou-Targhee National Forest, Palisades Ranger District. A small portion of this watershed lies within private land ownership.

The Bear Creek watershed (as with much of the Caribou Subsection) is characterized as being a "dry" vegetative area. Continuous conifer tree stands are found along the main Bear Creek drainage and tributaries. Open brush slopes are intermixed throughout the area. South and west facing slopes support brush vegetation and scattered conifer. North and east aspects that are wetter, support more dense vegetation. Tree height increase suggests better soil and climate conditions for conifer growth.

Tree composition is similar throughout the Caribou Subsection, and is made up of lodgepole pine (early succession species) and Douglas-fir (mid succession species). However, understory examination within many of the stands indicate that later succession tree species (alpine fir and Engelmann spruce) are invading the sites. Later successional species such as alpine fir are found in the understory. Spruce typically is found on wetter locations along Bear Creek, while alpine fir is wide spread throughout the analysis area.

Aspen stands (31 percent) are common throughout the analysis area. However, conifer encroachment is nearly complete in many of the stands and where only remnant aspen can be observed within the conifer stands.

Douglas-fir and lodgepole stands (47 percent) make up the bulk of timber vegetation in the area. Alpine fir trees have or are in the process of replacing some of the lodgepole pine and Douglas-fir stands. Some 99 percent of the conifer forests are in the mature or older seral stages.

Most of the analysis area is unroaded making traditional means of timber harvest difficult. Timber harvesting may have occurred in parts of the area in the past, but there is little evidence remaining of any widespread harvesting. Almost no harvest has taken place in the Englemann spruce fir type.

Tree age has not been determined by sampling means but insect activity indicates that most trees have reached optimum growth. Insect infestation is increasing as witnessed by the number of dead and dying trees in the watershed. Timber harvesting or salvage harvest would be environmentally difficult and expensive due to the lack of existing roads. With the exception of a few areas around existing road systems, timber harvest is likely economically unfeasible at the present time due to "roadless" issues.

ISSUES AND KEY QUESTIONS

Fires of significant size have been limited to small acreages due to fire suppression techniques with the exception of the Current Creek Fire of 1966, and the June Creek Fire in 1987. There has been some prescribed fire projects in the Bear Creek watershed, however they have been insignificant in size and accomplishment.

1. What is the past pattern and intensity of fire disturbance in the watershed?
2. How has fire suppression affected fuel loading and associated effects on fire frequency, severity, and burn patterns?
3. How has smoke management and, more specifically, air quality been affected in the past and how do we expect it to be affected in the future with the lack of fire, increased fuel loading and high risk of large fire occurrence?
4. Are there individual species or communities of plants and animals that are decreasing or increasing due to fire suppression?

What types of vegetative treatment fire/mechanical could be best utilized to restore the ecosystem to it's natural state?

CURRENT CONDITIONS

Current habitat types within the analysis area have contributed to past and present conditions. Douglas-fir is a fire-adapted species. Mature Douglas-fir has thick insulative bark that protects the inner cambium layer of the tree from moderately sever surface fire. Although mature Douglas-fir are resistant to moderate fire, saplings and seedlings are very susceptible due to resin blisters on the photosynthetic bark, low branching habit, close needles and thin bud scales present at the stages of development. Due to this susceptibility during the early development stages of Douglas-fir, the very dry fir habitat, low frequency, low intensity fires have maintained closed stands. When large fires have occurred within the fir type, fire has provided a mosaic of size classes and mixed species through less frequent, mixed severity fires.

The Caribou Subsection is 60 percent forested and 40 percent non-forested. The primary forest types are aspen (31 percent) and mixed lodgepole and Douglas-fir (47 percent). The interspersion of forest with sagebrush, grass/forb meadows and mountain brush provides good density of plant species.

Age class diversity is limited within the analysis area. Some limited timber management has occurred in the lodgepole pine/Douglas-fir types. Almost no harvest has taken place in the Englemann spruce/subalpine type. Some 99 percent of the conifer forests are in mature or older seral stages. Douglas-fir is becoming more dominant as it encroaches on stands of lodgepole pine and aspen or shrubs.

Evidence of insect attack is readily visible in the Douglas-fir type within the analysis area and has been substantiated in the 2002 Aerial Insect Disease Detection Survey conducted by the Forest Service.

Historic photographs from the early 1900's show that large aspen stands dominated much of the watershed. Due to fire management, suppression of wildfire has resulted in an evolution of the fir/pine habitat type. Shade tolerant species such as subalpine fir, Englemann spruce and Douglas-fir, are able to colonize an area due to the absence of fire. These species tend to be more susceptible to insects and disease and colonize quickly to provide large accumulations of horizontally and vertically continuous fuels.

The dominant fire dependant species that thrive in the fire environment are now less vigorous due to the stress placed on them through competition for resources and the introduction of new pathogens to the stand.

Approximately 90 percent of the analysis area is characterized by short interval fire regimes. These stands that historically burned in a mixed severity or nonlethal mosaic pattern, now have the potential to support a lethal/uniform stand replacement fire.

Fuels accumulations are steadily increasing and are setting the stage for high intensity, high mortality wildfire. Some plot surveys in the adjacent watershed indicate low tons/acre at this

time the stand density and latter fuels will contribute to the rapid fuel loading buildup and increase the danger of large fire events.

Forest structure can be divided into four aspects; age structure, species composition, mosaic patterns and vertical structure or fuel ladders (Kilgor 1981). Each of these aspects can, and in most cases, has been modified by fire exclusion. The effects fire suppression has on the structure of the forest directly impacts wildfire, hydrologic function, insects, pathogens and aquatic organisms.

Research in the Selway-Bitterroot Wilderness Area (Barrett and Arno), developed the concept of "fire regimes". Barrett and Arno found that each vegetative community responds to fire, or lack of fire, in similar ways. Habitat types have been grouped together by similar response patterns into the widely accepted fire regimes. A fire regime describes a plant community's expected response to fire. In general terms, fire regimes give us a description of the type of fire effects that can be expected for different layers of the forest vegetation.

Stand replacement fire, in which the majority of trees are killed, tend to favor seral species while low intensity mixed severity fire would favor shade tolerant species. This is evidenced on the Alpine Fire (in an adjacent watershed) of 2001 where 475 acres of primarily seral lodgepole pine was killed by a fast moving, wind driven fire that quickly spread into the tree canopy through the ladder fuels of shade tolerant trees.

Each fire regime entails three descriptors:

1) Fire type and severity (i.e. lethal, non lethal, mixed-severity).
2) Frequency of return interval (frequent, non-frequent).
3) Burn pattern (mosaic, uniform).

The **four regimes** within the analysis area are described separately:

Lodgepole Pine/ Subalpine Fir (LPP/SAF) Fire Regime – This fire regime generally occurs on cool, dry habitat types at 5000 – 8000 ft. elevations within the analysis area. Within the **llp/saf** fire regime, there are two distinct response patterns to wildfire. A lethal, uniform spread pattern resulting in stand replacement is found in mature lodgepole and subalpine stands. These stands have a return interval of fire at 155 years (Barrett 1993). After a stand replacement fire, lodgepole pine will predominate with Englemann spruce, Douglas-fir, and whitebark pine present to a lesser extent due to elevation. Subalpine fir will eventually dominate the site in late seral stands.
On drier, less steep sites with lodgepole pine, "understory burning" in the form of nonlethal/non-uniform spread patterns may occur. The less intense surface fire consumes the fine fuels without causing extensive mortality to the trees.

Douglas-fir/Subalpine Fir/Englemann Spruce (DF/SAF/ES) Fire Regime – This regime occurs on cool, moist northerly aspects, usually at higher elevations (5000 ft and >). Due to the high elevation and lower energy aspects, these sites generally do not dry out until late summer.

Uniform, stand replacement fires are typical, however a mosaic pattern leaving stands or whole groups of live trees occurs often. These stands are a result of fuel accumulations and much continuous ladder-fuels over 190 year intervals (Barrett 1993). Mature stands have higher fuel accumulations and much continuous ladder fuel within the stand structure.
Fires, once started, produce higher intensities resulting in higher tree mortalities mainly as a stand replacement event.
Seral species such as Douglas-fir, Englemann spruce, and subalpine fir become a major component with the lodgepole pine dying out before 160 years of age.

Quaking Aspen (ASP) Fire Regime – Quaking aspen is the most widely distributed native North America tree species (Little 1971, Sargent 1890). It grows in a great diversity of regions, environments and communities. Aspen is a component of several vegetation types within the Bear Creek Analysis Area. It grows in a broad range of elevations from 5500 feet to 8000 feet. Due to climatic conditions throughout the analysis area, the aspen sites rarely have an opportunity to burn naturally. Prescribed burning in the Current Creek area has been attempted on several instances in the spring with marginal results.
The combination of dry weather and cured fuels within the aspen forest does not occur every year. Most frequently, it occurs in the autumn, sometimes in late summer, and occasionally in spring. Late September and October can be wet, but often have periods of dry, sunny weather. At this time the herbaceous understory has frozen and is dead, but still largely upright, and can burn readily. The aspen canopy also loses its leaves in late September and October. If conditions continue to dry, layers of continuous loosely packed fine fuels develop, making the aspen more flammable. Most years however, aspen leaf-fall and the first heavy wet snow of autumn coincide in much of the aspen range.
Uniform stand replacement fires are non typical for this regime, however a mosaic burn pattern leaving stands or whole groups of live trees often happens. More often, the result is that the perimeter of the aspen stand is burned do to the grass, mountain brush, and sagebrush edge effect.
Soil moisture within the stand is also a contributing factor for the fires difficulty in burning through the stand. Although aspen does not burn readily, aspen trees are extremely sensitive to fire because of their thin bark. Despite the difficulty of getting fire to burn through aspen stands, the very sensitivity of the species, especially that of young trees, makes prescribed fire a viable tool for regenerating aspen.
A fire intense enough to kill the aspen over-story stimulates abundant suckering, however some suckering occurs after any fire disturbance. Low to moderate fire intensity will reduce the fuel load on the ground but may not be hot enough to remove the over-story in the stand.
Aspen require a maintenance level of disturbance such as fire, a wind event strong enough to up-root the trees, or mechanical treatment to assure regeneration of the stand. Without such an event, aspen is displaced by conifers, shrubs, and or grass.
Once the invasion of conifers starts, aspen are out-competed by the conifers for moisture and the aspen begins to die. This successional process is partially offset by aspen dominating areas where fire frequency intervals in conifer aspen stands. Stephen W. Barrett suggests the following fire frequency intervals in conifer aspen stands to have a range from 16 to 97 years and the average mean fire interval of 45 years (S.W. Barrett, Final Report, Fire Regimes On The Caribou/Targhee National Forest, 9/94, 25 pp).

Sagebrush/Mountain Brush/Grass Fire Regime – This regime makes up some 40 percent of vegetation types within the Bear Creek Watershed.
Annual precipitation for the area is normally around 20 inches annually, which usually comes in the form of snow between late October and the end of April. Rain showers are common in May, June and September, with July through September usually dry. Temperatures range from a maximum 90 degrees in the summer months to a minimum of < 20 in the winter.
The mountain brush communities consist of Chokecherry, Serviceberry, Bigtooth Maple, Rocky Mountain Juniper and Curleaf Mountain Mahogany, which make up approximately 23 percent of this habitat.
The non-forested areas also include mountain big sagebrush *(A. tridentate)*, snowbrush *(Ceanothus velutinous)*, bitterbrush *(Purshia tridentate)*, snowberry, horsebrush and rabbitbrush. Major grass components are Kentucky bluegrass *(Poa pratensis)*, mountain brome *(Bromus carinatus)*, slender wheatgrass *(Agropyron traahycaulum)*, and bluebunch wheatgrass *(Agropyron spicatum)*.
The forb component for the drier sites include balsamroot *(Balsamorphylla)*, arrowhead balsamroot *(Balsamorhiza sagittata)*, weaten hawksbeard *(Crepis occidentalis)*, and buckwheat *(Eriogonum caespitosum)*. On moist sites the forb component consists of meadow goldenrod *(Solidago Canadensis)*, cow parsnip *(Heracleum lanatum)*, mountain bluebells *(Mertrnsia ciliata)*, and tall and low larkspur *(Delphinium occidentiale and nelsoni)*.
There has been some treatment of sagebrush and mountain brush in the analysis area. The cycle required for treatment of sagebrush to maintain a desired canopy of 25 to 30 percent is approximately every 15 to 25 years (S.C. Bunting, B.M. Kilgore, Prescribed Burning sagebrush-Grass Rangelands in the Northern Great Basin), and (C.L. Bushey). Prior to wildfire suppression there is evidence of some widespread wildfire activity within the past 200 years, judging by fire scaring.
Most of the scrublands are also in late seral stages. Consequently, risks of large fires, insects and disease outbreaks are high. (FLMP 1997, III-64)

PAST CONDITIONS

Historically fire has been part of the ecosystem on the Caribou-Targhee National Forest. Reports as early as the 1800's indicate fire occurred throughout the area. W.P. Hunt reported on September 9, 1811 in his diary, "The valleys had recently been burned by grass fire" (Webster, R.L., Caribou History). This was the first record of fire on the Caribou when he mentioned that recent fire in the country between Fish Creek divide and present day Alexander Gap had destroyed all the horse feed.

Pioneer settlers reported that forest fires during the 1870's and as late as 1888, burned uncontrolled all summer long in the Caribou Forest. (Webster, R.L., Caribou History).

The Caribou Forest, within the original forest unit, was one of the largest burned areas in the intermountain area. The even aged lodgepole pine stands show that they were seedlings from 1855 to 1890.

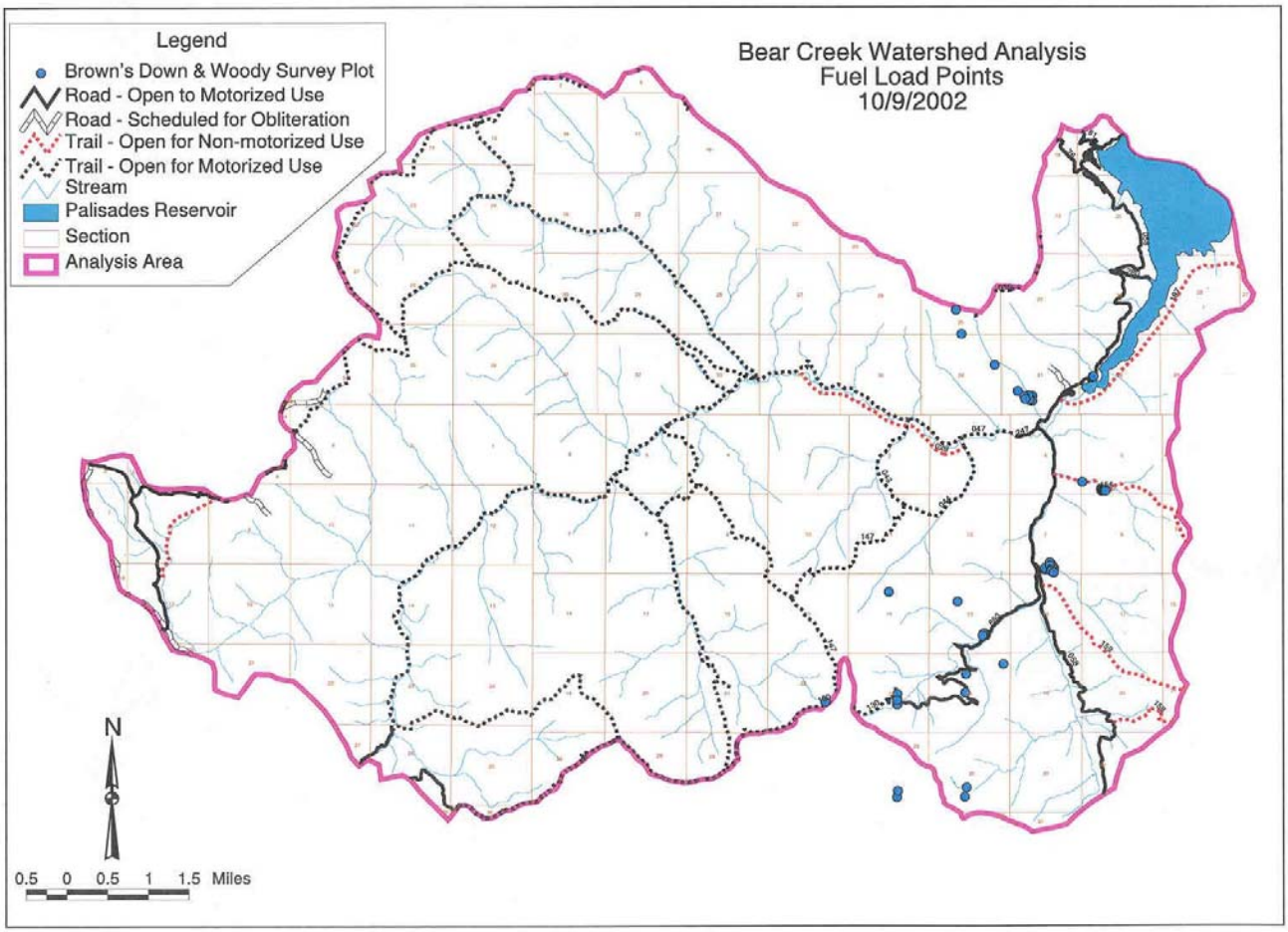
Native Americans set whole drainages on fire to improve grazing and wildlife habitats. (Lewis 1973), (Kay 1994; Russell 1983). Past history points to severe fires during the past 100 years that nearly destroyed most of the old fir stands.

TRENDS

During the summer of 2001, eleven fuel plots where surveyed within the Spring Creek drainage of the Bear Creek watershed. Of the eleven plots surveyed to determine tons per acre of fuel loading, an average of 14.52 tons per acre was calculated. The lowest accumulation was recorded at 2.60 tons/acre, and the highest was 36.68 tons/acre.
Within the next two decades, 25 percent of the analysis area will be outside its historical fire interval. With the current fuel loads averaging >14 tons/acre, the fuel bed is at a dangerously high volume for increasing the chances of intense, stand-replacement type wildfire.
Without restoration of prescribed fire, and or mechanical thinning methods to restore stand structure and allowing fire's natural role within the ecosystem, down woody material will continue to increase the fuel bed loads as standing timber falls to the ground due to insects and disease as indicated in the picture below.

Picture showing
grass, forbs and down woody debris.

Weather patterns continue to be dryer and warmer. Forest fuels are drying earlier in the spring and not recovering moisture in early spring and summer due to drought conditions experienced throughout the west.
Lightning associated with thunderstorms is common in late June through September that result in regular wildfire activity throughout the watershed. Due to the proximity of fire suppression forces and equipment, most fires in the Bear Creek watershed are kept small.


Legend
Brown's Down & Woody Survey Plot
Road - Open to Motorized Use
Road - Scheduled for Obliteration
Trail - Open for Non-motorized Use
Trail - Open for Motorized Use
Stream
Palisades Reservoir
Section
Analysis Area
Bear Creek Watershed Analysis
Fuel Load Points
10/9/2002
N
0.5 0 0.5 1 1.5 Miles

RECOMMENDATIONS

The following recommendations for restoration and protection improvements should be considered in order to improve the ecological balance within the watershed.

1. Use prescribed fire in specific areas of heavy fuel loading to reduce the chance of catastrophic or stand-replacement fire.
2. Reduce the ladder fuels through vegetation management projects within the analysis area where fuel loads are approaching 20 tons/acre in the timber types.
3. When possible and within management constraints, allow fire to spread naturally within fire use guidelines. A fire use plan is in the development stages for the Caribou Subsection and expected to be completed in 2004.
4. Utilize prescribed fire within sage/grass, and mountain brush areas where species, age class, and composition indicate the need to restore the ecological balance within the analysis area.
5. Develop an aggressive aspen regeneration program in order to restore aspen habitat throughout the watershed.

LITERATURE CITED OR REFERENCES

Arno, Stephen F. 1980. Forest Fire History in the Northern Rockies. Journal of Forestry. 78(8): 460-465.

Arno, S.F. and S.F. Barrett, 1991. Classifying Fire Regions and Defining Their Topographic Controls in Selway-Bitteroot Wilderness, Conference on Fire and Forest Meteorology, Missoula, MT.

Bartos, D. L. 2000. Landscape Dynamics of Aspen and Conifer Forests. Sustaining Aspen in western Landscapes: Symposium Proceedings, Grand Junction, CO. USDA Forest Service. Rocky Mountain Research Station, Fort Collins, CO. RMRS-P-18, pgs 5-6.

Bartos, D. L. and R. B. Campbell, Jr. 1998a. Decline of quaking aspen in the Interior West-Examples from Utah. Rangelands 20(1):17-24

Bradley, Anne F., William G. Fischer, and Nonan V. Noste. 1992. Fire Ecology of the Forest Habitat Types of Eastern Idaho and Western Wyoming. USDA Forest Service. Intermountain Research Station. GTR INT-290, 92 pgs.